

FINAL REPORT

TETROON EVALUATION PROGRAM

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ABSTRACT

The actual volume of a "constant volume" superpressured tetrahedron shaped balloon changes as the amount of superpressure is changed. The experimental methods used to measure these changes in volume are described and results are presented. The basic equations used to determine the amount of inflation gas required for a tetraon to float at a predetermined flight level are presented and inflation techniques discussed.

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MATHEMATICAL SYMBOLS

- σ - maximum tensile stress in tetroom material
 - ρ - density
 - h - length of basic tubular cylinder from which a tetroom is manufactured
 - k - constant
 - n - number of moles of gas
 - P - absolute pressure
 - ΔP - helium pressure inside tetroom less the air pressure outside tetroom
 - R - gas constant
 - t - material thickness
 - T - absolute temperature
 - V - volume of tetroom
 - W - weight
- - - - -

Subscripts:

- l - at launch
- o - initial value (V_o = volume at $\Delta P = 5$ mb)
- a - air
- b - ballast
- f - at float
- g - inflation gas
- p - payload
- t - tetroom

1. SUMMARY-

Three different sizes (1m^3 , 5m^3 , and 6m^3) of tetrahedron shaped balloons manufactured from a dyed red polyester film were studied by inflation techniques to determine volume accuracies and volume changes with changing stress levels or superpressure levels.

Review of the data show that at nominal skin stress levels of 6,000 psi and lower there is no measurable volume "creep" due to creep elongation of the polyester film. At a nominal skin stress of 8,000 psi, creep may be detectable, while at 10,000 psi the creep is definitely measurable and would significantly affect the floating altitude stability because of a changing volume.

This report explains the volume measurements and experimental techniques used. The normalized volumes are graphed for ease of interpretation and ease of comparison between the different sizes.

A complete explanation of basic inflation techniques is presented. Details of inflation equipment and mathematical tools to help in solving the technician's problem of "how to inflate a tetroon" are left to the discrimination of the user; however, some helpful suggestions are provided.

Some additional work is required to form a basis from which a comprehensive handbook on tetroon inflation and performance predictions can be made. Recommendations for this future work are presented.

2. BALLOON DESCRIPTIONS

Five balloons each of the three different sizes were tested. These balloons had the shape of tetrahedrons and are commonly referred to as tetroons. Instead of being manufactured from four equilateral triangular pieces of material, the tetroon is generally fabricated from a tube or cylinder of material of length h and circumference $2.31h$. The ends of this tubular piece of material are sealed off like a pillow would be on each end, except that the opposite ends are sealed in perpendicular skew directions.

When these balloons are inflated and pressurized they do not form a flat sided tetrahedron, but instead have rounding or bulging surfaces. The maximum material stressing occurs at the center of each bulging face and has a nominal maximum stress corresponding to the following empirical equation (reference 1):

$$\sigma = \frac{\Delta Ph}{4t} \quad (1)$$

The volume of the tetroom is nominally considered to be equal to $.26h^3$.

The smallest tetroom, Model No. T-PR51-1.000, is a $1m^3$ tetroom manufactured from polyester dyed red film with a skin thickness of $51\mu m$. The $5m^3$ tetroom is manufactured from $102\mu m$ thick red polyester film and has a part number of T-PR102-5.000. The $6m^3$ is manufactured from the same material as the $5m^3$ and it carries a part number of T-PR102-6.000.

The following table shows the various superpressure values required to produce the nominal stresses of interest. This table can easily be derived from the preceding stress equation, (1), for tetrooms.

Stress (psi)	ΔP (mb) Required for:		
	$1m^3$	$5m^3$	$6m^3$
2,000	17.9	20.9	19.8
4,000	35.8	41.9	39.5
6,000	53.7	62.8	59.2
8,000	71.6	83.6	79.0
10,000	89.5	104.6	98.7

3. CHOOSING AND INFLATING A TETROOM

In flying a tetroom the problem generally focuses upon two basic parameters, payload and altitude. The term altitude really implies a density level where T_{af} and P_{af} are known. A third parameter, ΔP_f , which must be defined is the desired pressurization of the tetroom above the ambient pressure.

For the purpose of this discussion it is assumed that for any particular tetroom the volume, V , is a unique function of ΔP as long as the tetroom is never stressed beyond its elastic capabilities (hysteresis volume effects assumed insignificant); i.e.,

volume = function dependent only on ΔP

or

$$V = f(\Delta P) \quad (2)$$

The floating density level of a tetroom is determined from the buoyancy equilibrium equation; i.e.,

System Weight = System Buoyancy

or

$$W_t + W_p + W_b = V_f \rho_{af} - V_f \rho_{gf} \quad (3)$$

The density of a gas is proportional to absolute pressure and inversely proportional to absolute temperature. Thus, the densities can be expressed as follows:

$$\rho_a = k_a \frac{P_a}{T_a} ; \rho_g = k_g \frac{P_g}{T_g} \quad \text{or} \quad (4)$$

$$\rho_{af} = k_a \frac{P_{af}}{T_{af}} ; \rho_g = k_g \frac{P_{gf}}{T_{gf}}$$

P_{gf} is the chosen value of absolute pressure which corresponds to the superpressure:

$$\Delta P_f = P_{gf} - P_{af} \quad (5)$$

T_{gf} is the absolute temperature of the inflation gas at the float level, and the supertemperature effects should not be ignored, i.e., $T_{gf} \neq T_{af}$.

Thus, the amount of ballast required can be calculated from the floating requirements using equations (3) and (4):

$$W_b = V_f \left[k_a \frac{P_{af}}{T_{af}} - k_g \frac{P_{gf}}{T_{gf}} \right] - W_p - W_t \quad (6)$$

If $W_b < 0$ the tetroom is too small and a larger one must be used. However, if too large of a tetroom is used then W_b becomes excessively large.

Once a tetroom is chosen the second problem is to determine how much gas (helium) to put in it. For any given tetroom the number of moles of gas it should contain can be calculated from the floating conditions by using the equation of state for a gas, $PV = nRT$:

$$n_g = \frac{P_{gf} V_f}{T_{gf} R} \quad (7)$$

At launch the tetroom must contain the same amount of gas such that:

$$n_g = \frac{P_{gl} V_l}{T_{gl} R} \quad (8)$$

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Two situations may exist at launch:

a) the tetraon may be flacid and not fully inflated,

or

b) the tetraon may be pressurized.

Under either situation, the following equation may be used to calculate V_l if the Net Lift at launch is measured; i.e.,

System Weight = System Buoyancy

or

$$W_t + W_p + W_b = \text{Net Lift} + V_l \rho_{al} - V_l \rho_{gl} \quad (9)$$

$$\text{Rearranging: } V_l = \frac{\text{Net Lift} + W_t + W_p + W_b}{\rho_{al} - \rho_{gl}} \quad (10)$$

Using the earlier expression for ρ , (4), substituted into (10) and using this expression for V_l in (8):

$$n_g = \frac{P_{gl}}{T_{gl}R} \left[\frac{\text{Net Lift} + W_t + W_p + W_b}{k_a \frac{P_{al}}{T_{al}} - k_g \frac{P_{gl}}{T_{gl}}} \right] \quad (11)$$

For an indoor inflation when the gas has been allowed to reach temperature equilibrium with the air, then $T_{al} = T_{gl}$, and:

$$n_g = \frac{P_{gl}}{R} \left[\frac{\text{Net Lift} + W_t + W_p + W_b}{k_a P_{al} - k_g P_{gl}} \right] \quad (12)$$

Depending on which of the two launch situations exist, this equation may be simplified even further. If the underinflated situation exists, then $P_{gl} = P_{al}$, and:

$$n_g = \frac{\text{Net Lift} + W_t + W_p + W_b}{R(k_a - k_g)} \quad (13)$$

For this situation, one would slowly inflate the balloon until the net lift reaches the value determined by:

$$\text{Net Lift} - R(k_a - k_g)n_g - (W_t + W_p + W_b) \quad (14)$$

which is (13) rearranged.

However, for the pressurized situation one would slowly inflate (by trial and error if necessary) until the right side of equation (12) satisfied the predetermined value for n_g .

It is easy to predict which of the two launch situations will exist as follows:

- 1) Assume that the tetroom would be just inflated to full, but with no overpressure.
- 2) Calculate n_g based upon $P_{gl} = P_{al}$ and $T_{gl} = T_{al}$, i.e.,

$$n_g = \frac{P_{al} V}{T_{al} R}$$

where

V = nominal, just full volume of the tetroom.

- 3) If this calculated value of n_g is less than the predetermined float requirement, then more gas would have to be added and the pressurized situation would exist.
- 4) If this calculated value of n_g is more than the predetermined float requirement, then less gas would be required and the underinflated situation would exist.

The above explanation describing how to choose and inflate a tetroom made two assumptions. The first assumption was that the V versus ΔP characteristics of the tetroom are unique; i.e., a single V vs. ΔP graph exists and the tetroom exhibits no volume hysteresis effects. This characteristic needs to be more fully evaluated, as explained later. Also, each tetroom should have its own actual volume measured to minimize errors in the float level due to manufactured volume variations.

The second assumption was that the temperature of the inflation gas at float is known. This is not true and supertemperature estimates must be made. The ambient conditions and material radiometric properties will affect the supertemperature. Reference 2 explains errors caused by such effects in more detail. This reference further discusses many other aspects of tetroom flying and is recommended reading prior to establishing a detailed manual.

4. EXPERIMENTAL VOLUME MEASUREMENTS

Each tetroom was inflated for the first time on the day it was to be tested. The inflation gas used was helium. The tetroom was initially inflated to a superpressure of 5 mb, and the volume

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was calculated as explained below. The complete testing cycle for a single tetraon lasted less than 8 hours. After the initial volume measurement data were taken, the balloon was then inflated to a constant superpressure for a time period of 4 hours. This superpressure was selected to correspond to nominal skin stresses of 2,000, 4,000, 6,000, 8,000, or 10,000 psi. One tetraon of each size was tested at this constant pressure for each of the corresponding skin stresses. This yields five tetraons of each size, or a total of 15. After this initial stressing of 4 hours, the pressure was increased so that the balloon would be stressed at 10,000 psi for 1 hour (for the cases of preliminary stressing at 10,000 psi, the tetraon was held at 10,000 psi for an additional hour). Then the pressure was lowered so that the tetraon would be stressed at 8,000 psi for 1/2 hour, the pressure was then lowered again for a skin stress of 6,000 psi for another 1/2 hour, and lowered again to attain 4,000 psi for 1/2 hour, and finally reduced to attain 2,000 psi for a final 1/2 hour. Thus, the actual stressing time was 7 hours.

4.1 Volume Calculations

As explained in section 3. the volume of any balloon inflated with a lifting gas can be calculated from the following equation:

$$V = \frac{\text{Net Lift} + W_t + W_p + W_b}{\rho_a - \rho_g} \quad (15)$$

For the experimental setup $W_p = W_b = 0$. Also, helium was used as the inflation gas so that, using equation (4):

$$V = \frac{\text{Net Lift} + W_t}{\frac{P_a}{T_a} \left(.348521 \frac{\text{kg } ^\circ\text{K}}{\text{m}^3 \text{ mb}} \right) - \frac{P_g}{T_g} \left(.048109 \frac{\text{kg } ^\circ\text{K}}{\text{m}^3 \text{ mb}} \right)} \quad (16)$$

Thus, to calculate the volume, one needs only to measure the net lift of the tetraon, the absolute pressure of the air, the absolute pressure of the helium (or pressure differential between the air and the helium since $P_g = P_a + \Delta P$), and the temperature of the air (assuming $T_a = T_g$). Accounting for these factors and the tare weight of the experimental setup, the equation used to calculate volume was:

$$V = \frac{W_t + \text{Scale Reading} + \text{Tare Weight}}{\frac{P_a}{T_a} \left(.348521 \frac{\text{kg } ^\circ\text{K}}{\text{m}^3 \text{ mb}} \right) - \frac{P_a + \Delta P}{T_a} \left(.048109 \frac{\text{kg } ^\circ\text{K}}{\text{m}^3 \text{ mb}} \right)} \quad (17)$$

4.2 Test Method

Each tetroom was initially tied to a kilogram balance scale prior to inflation. (See Figure 1.) When the tetroom became buoyant, it would rise up and pull up on the pan of the scale. Adjustments were made such that when calibrated weights equal to the net lift of the tetroom were placed on the pan of the scale, the scale pointer would point to its neutral or zero position. This technique of lift measurement provided a sensitivity such that the equilibrium under a particular steady state condition could be measured within $\pm 0.5\text{g}$ for the 1m^3 and $\pm 1.0\text{g}$ for the 5m^3 and 6m^3 tetrooms.

For all the 1m^3 tetrooms and the first 5m^3 tetroom tested, the recorded temperature was that measured with a standard laboratory thermometer calibrated in 1°C increments. During the testing of the first 5m^3 tetroom, Test #6, it became evident that temperature fluctuations in the test area between the top and the bottom of this much larger tetroom resulted in a requirement to more accurately estimate the true average temperature of the helium. Consequently, for all the remaining 5m^3 and 6m^3 tetrooms, an improved temperature average was attained by measuring the temperature near the bottom of the tetroom with the thermometer and at the top of the tetroom with a thermistor connected to a digital voltmeter readout. The temperature of the helium was assumed to be the average of the two readings.

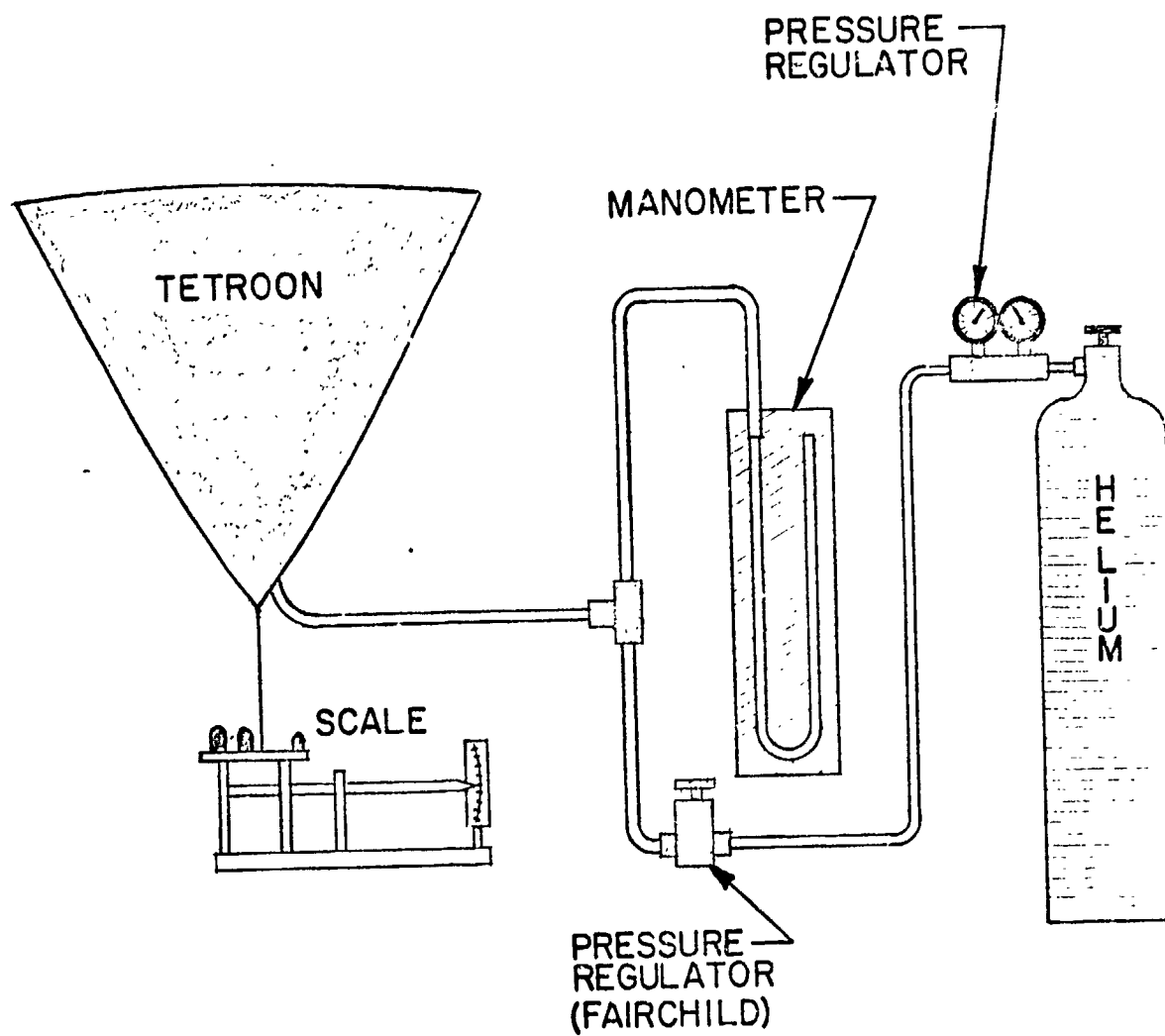
The barometric pressure was measured with a mercury cistern barometer calibrated in millibars. The superpressure of the tetroom was measured with a water manometer or mercury manometer, whichever was appropriate in the superpressure range of interest.

The inflation of each tetroom was regulated with two pressure regulators in series. The first pressure regulator, that connected directly to the helium bottle, was maintained at an output pressure of 20 psi. The second regulator was a Fairchild Model 10C, 0-2 psig range precision regulator.

4.3 Results

The data for each of the tetroom tests is included in the appendix. The initial volumes, those calculated from measurements taken at a superpressure of 5 mb, are listed below. In examining the table it is evident that the basic volume inaccuracies from manufacturing tolerances are significant and cannot be ignored.

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EXPERIMENTAL SET - UP

FIG. 1

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Balloon Type	Test #	V_0 (m^3)	V_0 -Nominal Volume
			Nominal Volume (%)
T-PR51-1.000	1	1.0595	6.0
	2	1.0554	5.5
	3	1.0586	5.9
	4	1.0439	4.6
	5	1.0479	4.8
T-PR102-5.000	6	5.058	1.2
	7	5.127	2.5
	8	5.096	1.9
	9	5.047	0.9
	10	5.047	0.9
T-PR102-6.000	11	5.976	-0.4
	12	6.238	4.0
	13	6.206	3.4
	14	6.230	3.8
	15	6.198	3.3

In order to compare results between different tetraon sizes, it was necessary to produce graphs of the actual volume divided by the initial volume, V/V_0 , versus time. These graphs are found in Figures 2 through 6. In reviewing these figures, it is quite apparent that for the prestressing at 2,000, 4,000, and 6,000 psi there is no volume creep during the first 4 hours. Also, for the same test, it does not appear that the prestressing value affects the second part of the test where the stress limits are raised to 10,000 psi and then slowly lowered.

The prestressing at 8,000 psi may indicate a slow trend towards increased volume during the first 4 hours, but once again the last part of the test does not seem to be affected by the initial stressing since the results are very similar to those in Figures 2, 3 and 4.

Figure 6 very definitely shows that at a nominal stress level of 10,000 psi there is significant volume growth which, as expected, affects the results of the second part of the test.

It should be remembered that the $1m^3$ balloons were made from 51 μm material, while the 5 m^3 and 6 m^3 balloons were made from 102 μm material. Consequently, both materials would have been manufactured from separate cast extrusion runs of a nearly identical polymer. The variations in running conditions during the making of the films would produce films with slightly varying characteristics.

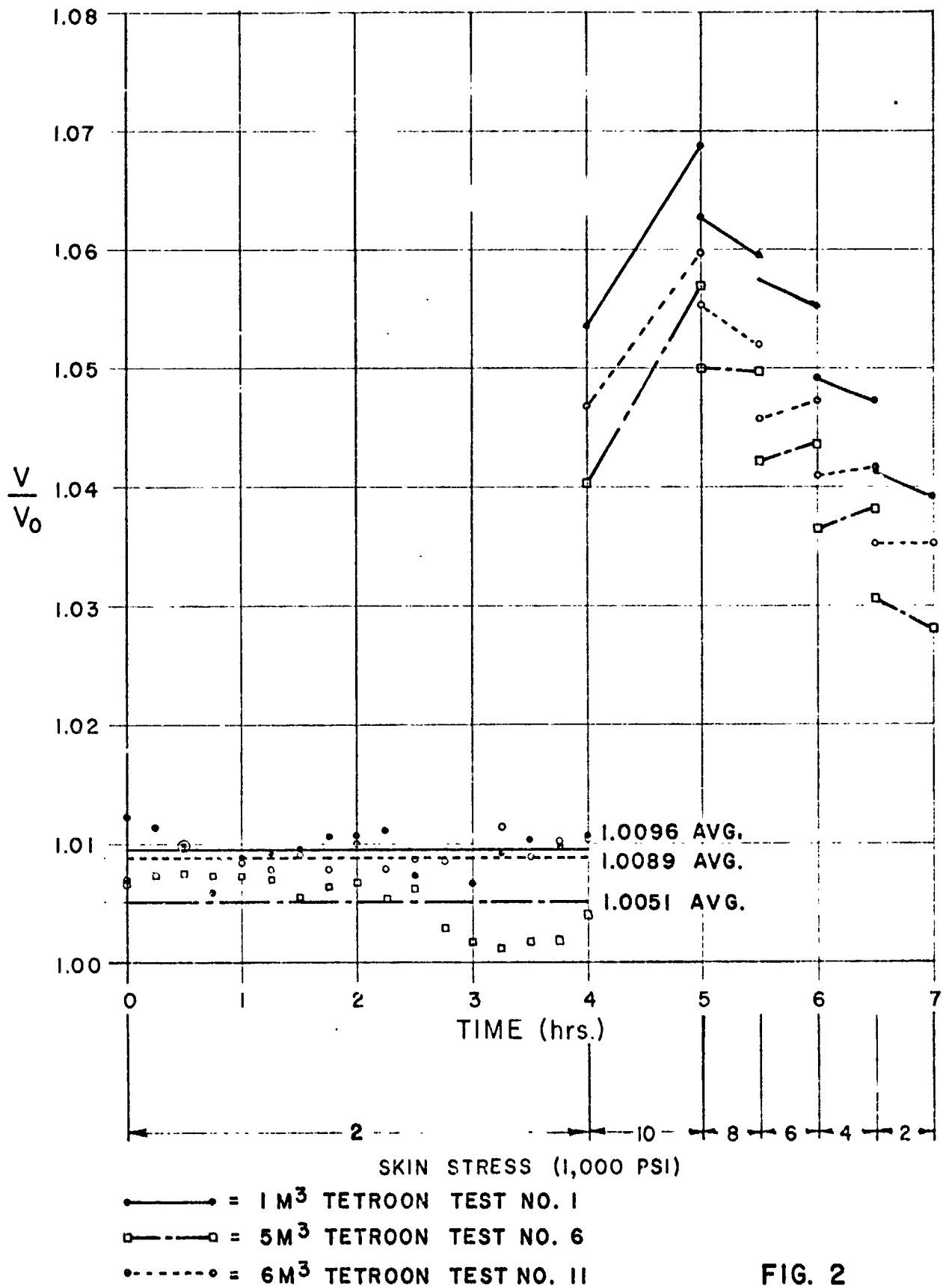


FIG. 2

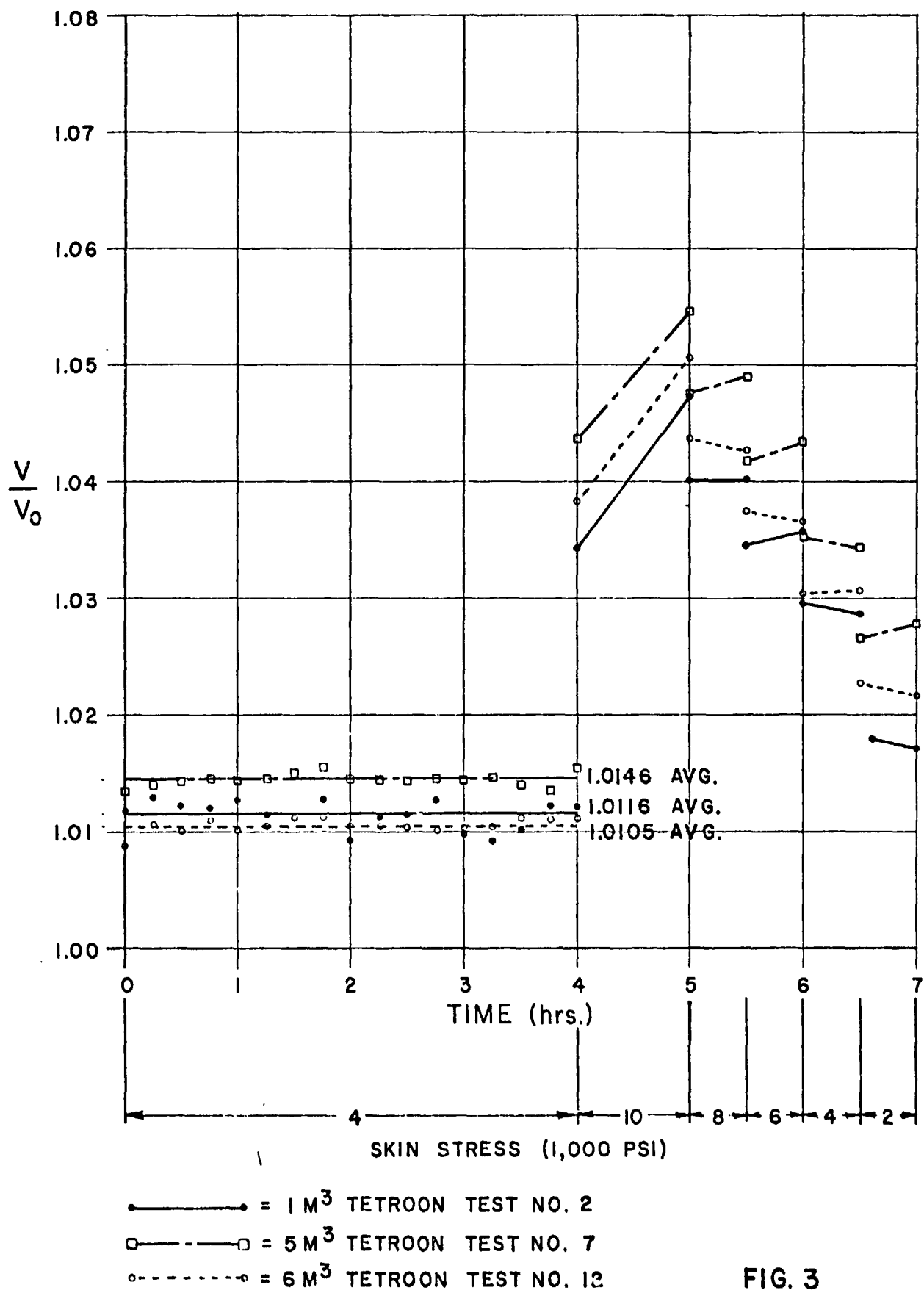


FIG. 3

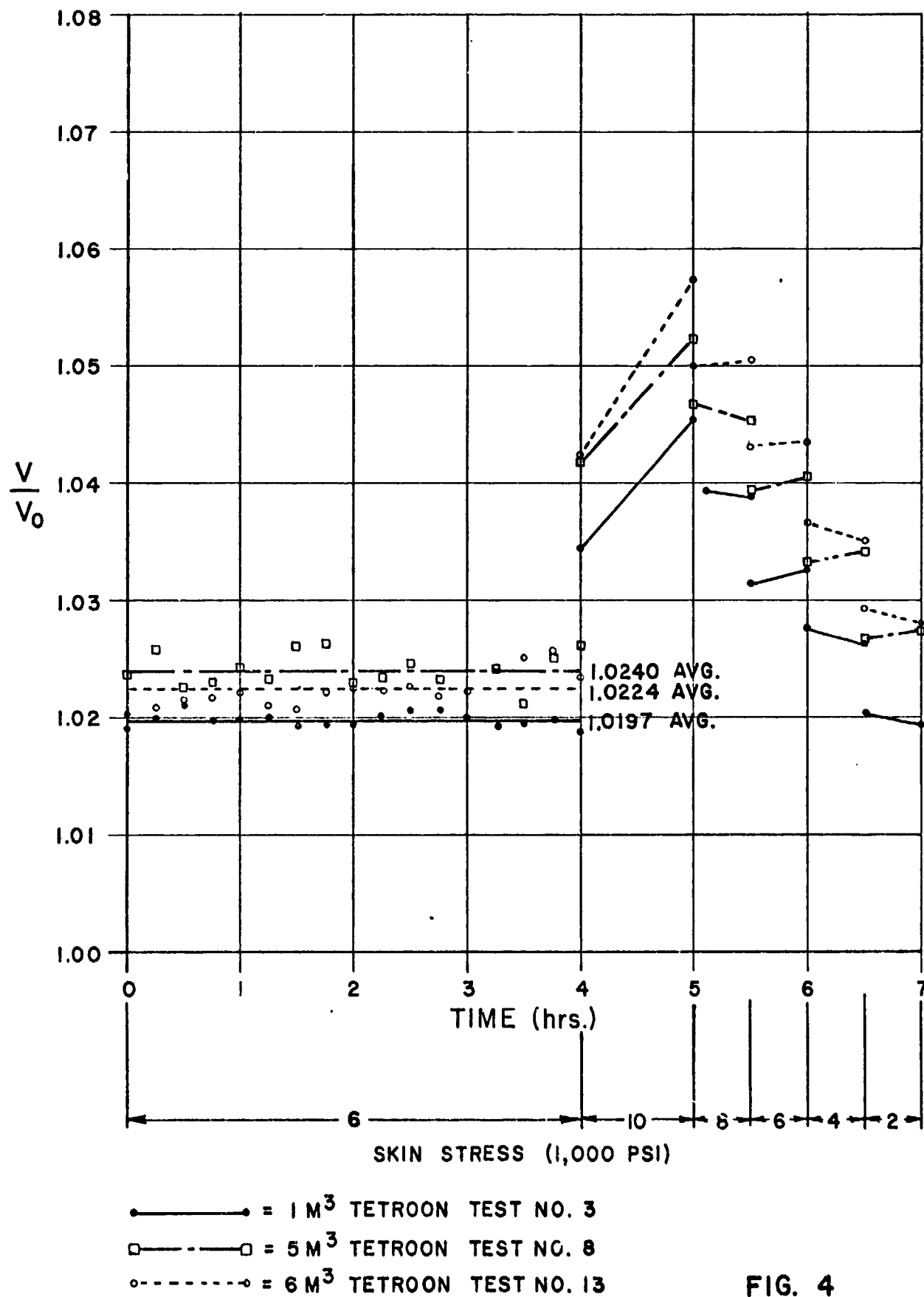
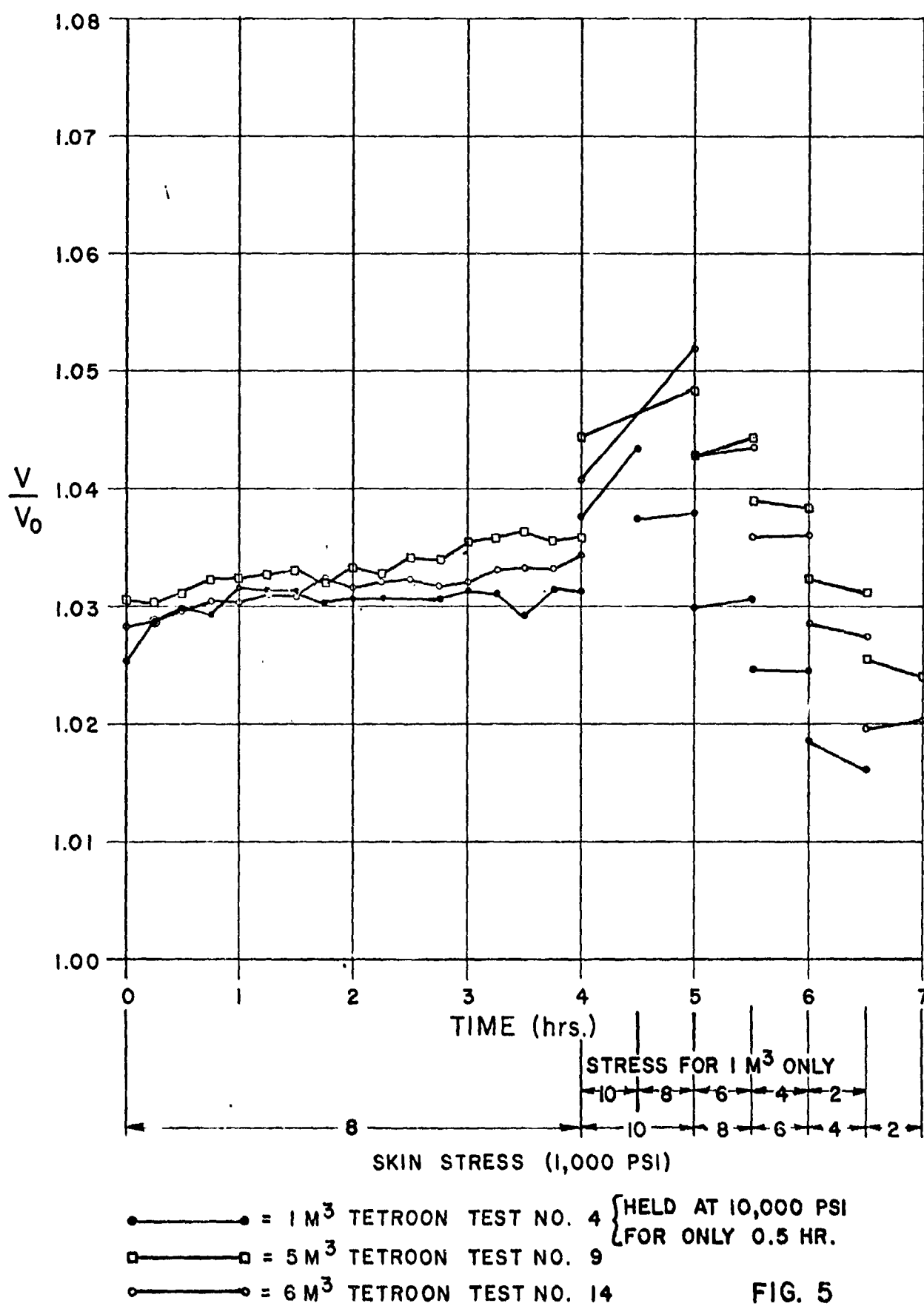


FIG. 4



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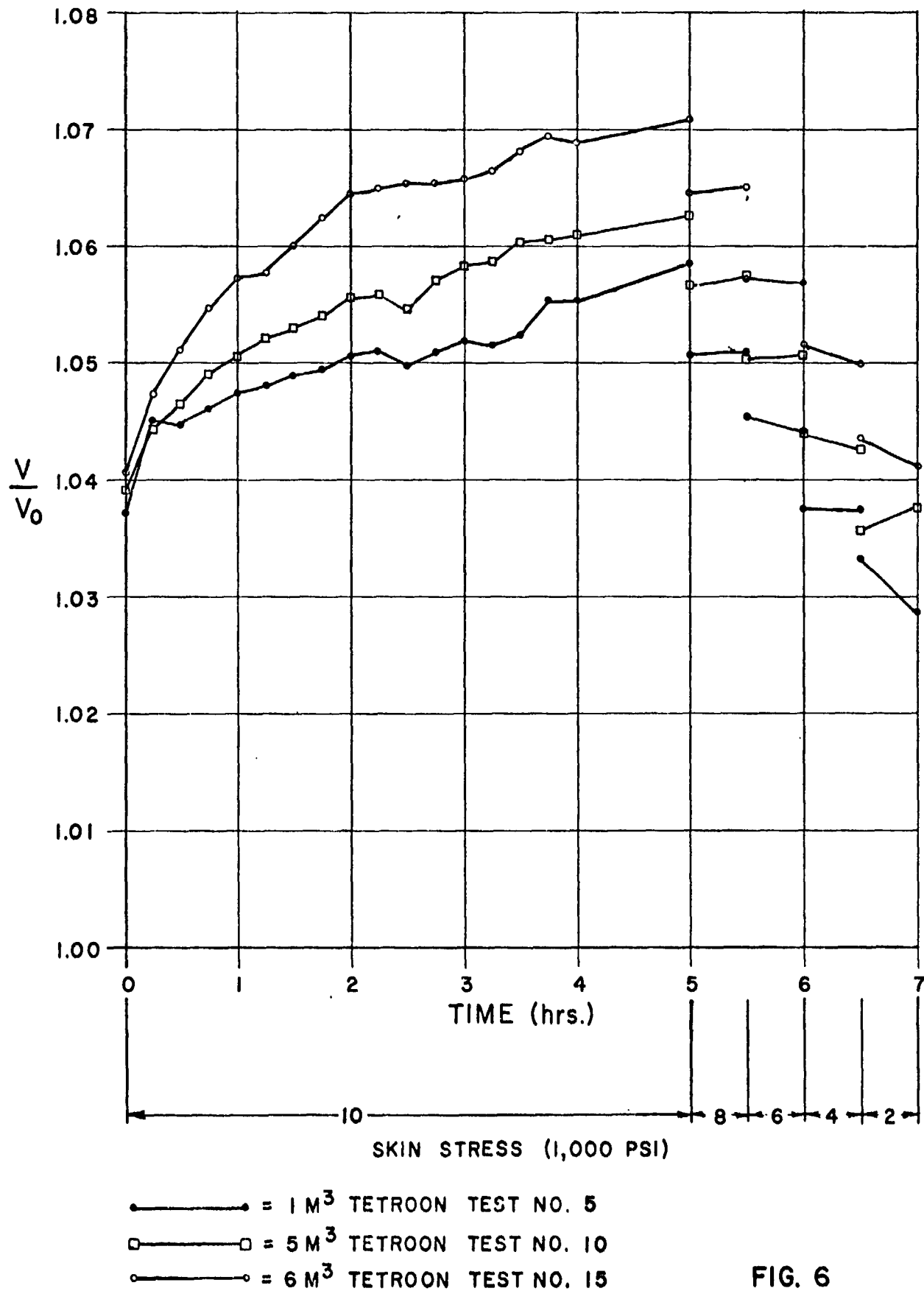


FIG. 6

5. CONCLUSIONS AND RECOMMENDATIONS

In order to predict tetroom flight characteristics or to analyze flight trajectories, it would be extremely helpful if the tetrooms were to be operating in an elastic region such that the individual volumes would be a unique function of the superpressure. The tests performed under this study suggest that this may be the case for tetrooms experiencing stress levels of 6,000 psi and lower, and even possibly as high as 8,000 psi. It is unfortunate that the sequence of testing did not allow for a confirmation of the hypothesis of elastic volume recovery. Future tests of the nature of those performed here would help to prove or disprove this hypothesis.

It is possible that the tetroom volume may also become a function of skin temperature as well as superpressure; i.e., the physical characteristics of the film may change with actual film temperature. This is known to be true for large temperature changes, but it may be possible to demonstrate that the volume changing characteristics are relatively insignificant over the temperature regions of interest. In order to accurately assess this characteristic of tetrooms it would be desirable to perform volume measurement tests on tetrooms inside temperature controlled chambers.

It must also be remembered that superpressure is a function of supertemperature. It consequently becomes a problem to predict what the actual superpressure on a tetroom is with a changing radiation environment or with variations in the radiometric properties of the membrane material. It would be desirable to measure the actual supertemperature between the helium and the air of flying tetrooms under a variety of ambient conditions and with different levels of coloring in the film. With accurate supertemperature information, one can much more accurately predict the value of the helium temperature at float which is necessary for accurate volume prediction.

In summary, it would be desirable that the following tests be performed under future work.

- a) Volume hysteresis effect when stress levels of 6,000 and 8,000 psi are not exceeded.
- b) Volume increase characteristics at a variety of tetroom skin temperatures.
- c) Supertemperature measurements during flight on tetrooms under a variety of ambient conditions and with a variety of materials.

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References

1. Grass, L. A., Superpressure Balloon for Constant Level Flight, AFCRL-62-824, Air Force Cambridge Research Laboratories. August 1962.
2. Delver, Norbert F., and Booth, Howard G., The Deployment of Superpressured Balloons, COM-75-10451, Weather Bureau Research Station, Las Vegas, Nevada. March 1965.

Appendix

Test # 1

Date: 21 December 1976

Tetroon Type: T-PR51-1.000

Tetroon Weight: 0.4687 kg

Tare Weight: 0.000 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	.5795	5	967.7	293.6	1.0595	1.0000
0	.5830	17.7	967.6	293.6	1.0726	1.0124
.25	.5817	17.7	967.2	293.6	1.0717	1.0115
.50	.5815	17.7	967.1	293.1	1.0698	1.0097
.75	.5805	17.9	969.9	293.5	1.0657	1.0059
1.00	.5800	17.7	966.5	293.4	1.0689	1.0089
1.25	.5800	17.7	966.1	293.4	1.0693	1.0092
1.50	.5798	17.5	965.8	293.4	1.0694	1.0093
1.75	.5790	17.5	965.2	293.5	1.0707	1.0106
2.00	.5787	17.7	964.9	293.5	1.0708	1.0107
2.25	.5790	17.4	964.75	293.5	1.0712	1.0110
2.50	.5743	17.8	964.2	294.9	1.0671	1.0072
3.00	.5670	17.9	963.4	295.2	1.0667	1.0068
3.25	.5670	17.7	962.95	295.8	1.0693	1.0092
3.50	.5673	17.7	962.2	295.8	1.0704	1.0103
3.75	.5668	17.8	961.8	295.7	1.0700	1.0099
4.00	.5665	17.9	960.6	295.6	1.0707	1.0106
4.00	.5790	89.4	959.6	296.0	1.1163	1.0536
5.00	.5937	89.4	958.7	295.9	1.1324	1.0688
5.00	.5910	71.5	958.7	295.9	1.1261	1.0629
5.50	.5870	71.5	958.5	296.0	1.1226	1.0596
6.00	.5860	53.7	958.0	295.8	1.1180	1.0552
6.00	.5830	35.8	958.0	295.8	1.1115	1.0491
6.50	.5830	35.3	957.7	295.2	1.1095	1.0472
6.50	.5800	17.9	957.7	295.2	1.1031	1.0412
7.00	.578	18.1	957.2	295.0	1.1008	1.0390

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Test #2
 Tetron Type: T-PR51-1.000
 Tetron Weight: 0.4692 kg
 Tare Weight: 0.013 kg

Date: 28 December 1976

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	.5444	5.0	956.0	295.0	1.0554	1.0000
0	.5522	35.8	955.95	294.8	1.0683	1.0122
.25	.5537	35.8	955.6	294.5	1.0691	1.0130
.50	.5524	35.8	955.8	294.7	1.0683	1.0122
.75	.5524	35.8	955.65	294.6	1.0681	1.0120
1.00	.5524	35.8	955.2	294.7	1.0689	1.0128
1.25	.5507	36.3	955.0	294.7	1.0675	1.0115
1.50	NR	NR	NR	NR	NR	NR
1.75	.5507	35.8	954.6	295.0	1.0690	1.0129
2.00	.5407	35.8	954.2	296.7	1.0652	1.0093
2.25	.5457	35.8	954.1	295.8	1.0672	1.0112
2.50	.5457	36.0	954.1	295.9	1.0676	1.0116
2.75	.5472	35.8	953.9	295.8	1.0690	1.0129
3.00	.5427	35.8	953.75	296.2	1.0659	1.0099
3.25	.5407	35.8	953.0	296.3	1.0651	1.0092
3.50	.5427	35.8	953.0	296.0	1.0661	1.0101
3.75	.5437	36.3	952.1	296.0	1.0682	1.0121
4.00	.5437	35.8	951.7	295.9	1.0682	1.0121
4.00	.5577	89.45	951.5	295.5	1.0915	1.0342
5.00	.5687	89.45	950.9	295.9	1.1052	1.0472
5.00	.5647	71.56	950.9	295.9	1.0976	1.0400
5.50	.5637	71.56	950.7	296.2	1.0979	1.0403
5.50	.5617	53.67	950.6	296.0	1.0919	1.0346
6.00	.5637	53.67	950.7	295.8	1.0931	1.0357
6.00	.5607	35.8	950.7	295.8	1.0867	1.0297
6.50	.5602	35.8	951.1	295.8	1.0857	1.0287
6.62	.5512	17.9	951.3	296.2	1.0743	1.0179
7.00	.5517	17.9	951.8	296.0	1.0735	1.0171

Test #3

Date: 30 December 1976

Tetroon Type: T-PR51-1.000

Tetroon Weight: 0.4704 kg

Tare Weight: 0.0165 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	.5365	5	950.1	295.0	1.0586	1.000
0	.5473	53.7	950.1	295.0	1.0787	1.0190
.25	.5483	53.7	950.1	295.0	1.0797	1.0199
.50	.5493	53.7	950.1	295.0	1.0808	1.0210
.75	.5483	53.7	950.1	294.9	1.0794	1.0197
1.00	.5483	53.7	950.1	295.0	1.0797	1.0199
1.25	.5483	53.7	950.0	295.0	1.0798	1.0200
1.50	.5473	53.7	950.0	295.0	1.0788	1.0191
1.75	.5475	53.7	950.1	295.0	1.0789	1.0192
2.00	.5475	53.7	950.0	295.0	1.0790	1.0193
2.25	.5475	53.7	949.25	295.0	1.0799	1.0201
2.50	.5478	53.7	949.1	295.0	1.0803	1.0205
2.75	.5473	53.7	948.6	295.0	1.0804	1.0206
3.00	.5463	53.7	948.3	295.0	1.0797	1.0199
3.25	.5465	53.7	948.1	294.9	1.0788	1.0191
3.50	.5455	53.7	947.75	294.9	1.0791	1.0194
3.75	.5455	53.7	947.3	295.0	1.0796	1.0198
4.00	.5438	53.7	947.1	295.0	1.0785	1.0188
4.00	.5528	89.5	946.9	295.1	1.0952	1.0346
5.00	.5633	89.5	946.3	295.0	1.1066	1.0453
5.10	.5603	71.6	946.2	295.0	1.1001	1.0392
5.50	.5598	71.6	946.0	295.0	1.0998	1.0389
5.50	.5553	53.7	946.0	295.0	1.0918	1.0314
6.00	.5553	53.7	945.5	295.2	1.0931	1.0326
6.00	.5533	35.8	945.4	295.2	1.0878	1.0276
6.50	.5523	35.8	945.1	295.0	1.0863	1.0262
6.50	.5493	17.8	945.1	295.0	1.0799	1.0201
7.00	.5488	17.8	944.8	294.8	1.0790	1.0193

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Test #4

Date: 18 January 1977

Tetroon Type: T-PR51-1.000

Tetroon Weight: 0.4664 kg

Tare Weight 0.0158 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
0	.5561	5	975.3	294.9	1.0459	1.0000
0	.5700	71.6	975.4	295.2	1.0726	1.0255
.25	.5735	71.6	975.7	295.2	1.0759	1.0287
.50	.5755	71.6	975.7	295.0	1.0772	1.0299
.75	.5750	71.6	975.65	294.9	1.0764	1.0292
1.00	.5770	71.6	975.8	295.1	1.0790	1.0316
1.25	.5770	71.6	975.9	295.0	1.0785	1.0312
1.50	.5780	71.6	975.8	294.7	1.0785	1.0312
1.75	.5760	71.6	976.0	295.1	1.0777	1.0304
2.00	.5760	71.6	976.0	295.2	1.0781	1.0308
2.25	.5760	71.6	976.0	295.2	1.0781	1.0308
2.75	.5720	71.6	975.55	296.2	1.0781	1.0308
3.00	.5740	71.6	975.5	295.8	1.0788	1.0315
3.25	.5730	71.6	975.6	296.0	1.0784	1.0311
3.50	.5705	71.6	975.7	296.2	1.0764	1.0292
3.75	.5730	71.6	975.4	296.1	1.0790	1.0316
4.00	.5720	71.6	975.1	296.2	1.0786	1.0313
4.00	.5750	89.4	974.7	296.2	1.0854	1.0378
4.50	.5800	89.4	974.1	296.3	1.0916	1.0437
4.50	.5770	71.6	974.1	296.3	1.0853	1.0377
5.00	.5770	71.6	973.8	296.3	1.0856	1.0380
5.00	.5720	53.7	973.8	296.3	1.0773	1.0300
5.50	.5710	53.7	973.8	296.7	1.0777	1.0304
5.50	.5685	35.8	973.8	296.7	1.0719	1.0249
6.00	.5685	35.8	972.8	296.3	1.0716	1.0246
6.00	.5656	17.9	972.8	296.3	1.0655	1.0187
6.50	.5616	17.9	972.6	296.6	1.0627	1.0161

Test #5

Date: 20 January 1977

Tetroon Type: T-PR51-1.000

Tetroon Weight: 0.4677 kg

Tare Weight: 0.0168 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V₀</u>
Initial	.5313	5	954.95	295.7	1.0479	1.0000
0	.5536	89.4	955.1	295.9	1.0869	1.0372
.25	.5621	89.4	955.45	295.9	1.0952	1.0451
.50	.5621	89.4	955.55	295.8	1.0949	1.0449
.75	.5626	89.4	955.85	296.1	1.0962	1.0461
1.00	.5646	89.4	956.30	296.1	1.0977	1.0475
1.25	.5651	89.4	956.65	296.2	1.0982	1.0480
1.50	.5666	89.4	956.85	296.1	1.0992	1.0490
1.75	.5676	89.4	957.25	296.1	1.0998	1.0495
2.00	.5686	89.4	957.45	296.2	1.1009	1.0506
2.25	.5686	89.4	957.45	296.3	1.1013	1.0510
2.50	.5676	89.4	957.50	296.3	1.1002	1.0499
2.75	.5686	89.4	957.50	296.3	1.1013	1.0510
3.00	.5696	89.4	957.40	296.3	1.1024	1.0520
3.25	.5686	89.4	957.30	296.4	1.1019	1.0515
3.50	.5681	89.4	957.30	296.5	1.1028	1.0524
3.75	.5726	89.4	957.50	296.4	1.1058	1.0553
4.00	.5726	89.4	957.5	296.4	1.1058	1.0553
5.00	.5736	89.4	957.5	297.0	1.1091	1.0584
5.00	.5691	71.6	957.5	297.0	1.1011	1.0508
5.50	.5691	71.6	957.7	297.1	1.1012	1.0509
5.50	.5666	53.7	957.7	297.1	1.0953	1.0452
6.00	.5656	53.7	957.8	297.0	1.0941	1.0441
6.00	.5621	35.8	957.8	297.0	1.0872	1.0375
6.50	.5616	35.8	957.8	297.2	1.0870	1.0373
6.50	.5606	17.85	957.8	297.2	1.0827	1.0332
7.00	.5596	17.85	957.9	296.2	1.0779	1.0286

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Test #6
 Tet.oon Type: T-PR102-5.000
 Tet.oon Weight: 2.631 kg
 Tare Weight: 0.013 kg

Date: 25 January 1977

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V_0</u>
Initial	2.310	5	964.8	295.7	5.058	1.000
0	2.334	20.9	965.3	295.7	5.092	1.0067
.25	2.337	20.9	965.35	295.6	5.095	1.0073
.50	2.335	20.9	965.30	295.8	5.096	1.0075
.75	2.333	20.9	965.20	295.8	5.095	1.0073
1.00	2.334	20.9	965.10	295.7	5.095	1.0073
1.25	2.337	20.9	965.15	295.5	5.094	1.0071
1.50	2.325	20.9	965.30	295.7	5.085	1.0053
1.75	2.331	20.9	965.30	295.7	5.091	1.0065
2.00	2.328	20.9	965.40	296.0	5.092	1.0067
2.25	2.322	20.9	965.30	295.9	5.085	1.0053
2.50	2.321	20.9	965.20	296.2	5.090	1.0063
2.75	2.312	20.9	965.20	295.7	5.072	1.0028
3.00	2.308	20.9	965.30	295.7	5.067	1.0018
3.25	2.305	20.9	965.30	295.7	5.064	1.0012
3.50	2.308	20.9	965.30	295.8	5.067	1.0018
3.75	2.308	20.9	965.10	295.8	5.068	1.0020
4.00	2.314	20.9	965.05	295.9	5.078	1.0040
4.00	2.420	104.6	965.05	296.0	5.262	1.0403
5.00	2.498	104.6	964.80	296.1	5.346	1.0569
5.00	2.483	83.6	964.80	296.1	5.311	1.0500
5.50	2.486	83.6	964.85	295.8	5.309	1.0496
5.50	2.467	62.8	964.85	295.8	5.271	1.0421
6.00	2.471	62.8	964.9	296.0	5.273	1.0435
6.00	2.455	41.9	964.9	296.0	5.243	1.0366
6.50	2.457	41.9	965.1	296.1	5.246	1.0372
6.50	2.443	20.9	965.1	296.1	5.213	1.0306
7.00	2.433	20.9	965.35	296.0	5.200	1.0281

Test #7
 Tetron Type: T-PR51-5.000
 Tetron Weight: 2.618 kg
 Tare Weight: 0.012 kg

Date: 27 January 1977

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	2.438	5	970.9	294.8	5.127	1.000
0	2.473	41.9	971.0	295.1	5.198	1.0138
.25	2.476	41.9	971.1	295.0	5.199	1.0140
.50	2.478	41.9	971.45	295.1	5.201	1.0144
.75	2.478	41.9	971.9	295.3	5.202	1.0146
1.00	2.476	41.9	972.1	295.4	5.201	1.0144
1.25	2.478	41.9	972.25	295.4	5.202	1.0146
1.50	2.479	41.9	972.40	295.5	5.204	1.0150
1.75	2.481	41.9	972.6	295.6	5.207	1.0156
2.00	2.477	41.9	972.75	295.6	5.202	1.0146
2.25	2.479	41.9	972.85	295.5	5.202	1.0146
2.50	2.479	41.9	973.0	295.5	5.201	1.0144
2.75	2.480	41.9	973.35	295.7	5.203	1.0148
3.00	2.469	41.9	973.70	296.1	5.201	1.0144
3.25	2.469	41.9	973.7	296.2	5.203	1.0148
3.50	2.468	41.9	973.85	296.3	5.199	1.0140
3.75	2.465	41.9	973.75	296.3	5.197	1.0137
4.00	2.473	41.9	973.80	296.4	5.206	1.0154
4.00	2.558	104.6	973.8	296.6	5.352	1.0439
5.00	2.606	104.9	973.8	297.0	5.408	1.0548
5.00	2.588	83.6	973.8	297.0	5.371	1.0476
5.50	2.588	83.6	973.25	297.2	5.378	1.0490
5.50	2.571	62.8	973.25	297.2	5.342	1.0419
6.00	2.576	62.8	973.20	297.3	5.349	1.0433
6.00	2.553	41.9	973.2	297.3	5.307	1.0351
6.50	2.551	41.9	973.2	297.2	5.303	1.0343
6.50	2.530	20.9	973.2	297.2	5.264	1.0267
7.00	2.530	20.9	973.3	297.6	5.270	1.0279

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Test #8
 Tetron Type: T-PR102-5.000
 Tetron Weight: 2.627 kg
 Tare Weight: 0.024 kg

Date: 2 February 1977

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V₀</u> <u>—</u>
Initial	2.276	5	954.0	296.2	5.096	1.000
0	2.345	62.8	954.0	296.1	5.217	1.0237
.25	2.346	62.8	954.0	296.2	5.220	1.0259
.50	2.335	62.8	954.1	296.4	5.211	1.0226
.75	2.341	62.8	954.15	296.2	5.213	1.0230
1.00	2.342	62.8	954.10	296.5	5.220	1.0243
1.25	2.339	62.8	954.7	296.6	5.215	1.0234
1.50	2.350	62.8	954.9	296.5	5.224	1.0251
1.75	2.353	62.8	955.0	296.4	5.225	1.0253
2.00	2.337	62.8	955.0	296.7	5.213	1.0230
2.25	2.340	62.8	955.0	296.6	5.215	1.0234
2.50	2.348	62.8	955.15	296.6	5.222	1.0247
2.75	2.338	62.8	955.30	296.8	5.215	1.0234
3.25	2.343	62.8	955.10	296.7	5.219	1.0241
3.50	2.328	62.8	955.0	296.7	5.204	1.0212
3.75	2.345	62.8	954.9	296.8	5.224	1.0251
4.00	2.343	62.8	954.5	297.1	5.229	1.0261
4.00	2.383	104.6	954.5	297.1	5.309	1.0418
5.00	2.428	104.6	953.9	297.3	5.363	1.0524
5.00	2.419	83.6	953.9	297.3	5.335	1.0469
5.50	2.408	83.6	953.7	297.4	5.326	1.0451
5.50	2.398	62.8	953.7	297.4	5.297	1.0394
6.00	2.403	62.8	953.3	297.3	5.303	1.0406
6.00	2.385	41.9	953.3	297.3	5.265	1.0332
6.50	2.388	41.9	953.0	297.3	5.270	1.0341
6.50	2.370	20.9	953.0	297.3	5.232	1.0267
7.00	2.375	20.9	953.0	297.2	5.236	1.0275

Test #9
 Tetroom Type: T-PR102-5.000
 Tetroom Weight: 2.623 kg
 Tare Weight: 0.009 kg

Date: 7 February 1977

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	2.283	5	961.7	296.4	5.047	1.000
0	2.368	83.6	961.7	296.4	5.202	1.0307
.25	2.366	83.6	961.65	296.4	5.200	1.0303
.50	2.368	83.6	961.6	296.5	5.204	1.0311
.75	2.373	83.6	961.5	296.5	5.210	1.0323
1.00	2.373	83.6	961.45	296.6	5.210	1.0325
1.25	2.375	83.6	961.4	296.6	5.213	1.0329
1.50	2.375	83.6	961.25	296.6	5.214	1.0331
1.75	2.370	83.6	961.15	296.6	5.209	1.0321
2.00	2.373	83.6	961.3	296.7	5.215	1.0333
2.25	2.370	83.6	961.35	296.8	5.213	1.0329
2.50	2.375	83.6	961.35	296.9	5.220	1.0343
2.75	2.374	83.6	961.4	296.9	5.219	1.0341
3.00	2.380	83.6	961.3	296.9	5.226	1.0355
3.25	2.380	83.6	961.25	297.0	5.228	1.0359
3.50	2.377	83.6	961.30	297.4	5.231	1.0365
3.75	2.371	83.6	961.25	297.5	5.227	1.0357
4.00	2.373	83.6	961.10	297.4	5.228	1.0359
4.00	2.398	104.6	961.20	297.4	5.272	1.0446
5.00	2.408	104.6	961.0	297.9	5.293	1.0487
5.00	2.397	83.6	961.0	297.9	5.263	1.0428
5.50	2.408	83.6	961.0	297.7	5.271	1.0444
5.50	2.400	62.8	961.0	297.7	5.244	1.0390
6.00	2.405	62.8	961.1	297.3	5.241	1.0384
6.00	2.394	41.9	961.1	297.3	5.212	1.0327
6.50	2.387	41.9	961.1	297.4	5.204	1.0311
6.50	2.377	20.9	961.1	297.4	5.176	1.0256
7.00	2.370	20.9	961.1	297.4	5.169	1.0242

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Test #10

Date: 8 February 1977

Tetroon Type: T-PR102-5.000

Tetroon Weight: 2.619 kg

Tare Weight: .004 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}$K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	2.280	5	958.3	296.1	5.047	1.000
0	2.389	104.6	958.3	296.0	5.245	1.0392
.25	2.412	104.6	958.25	296.1	5.271	1.0444
.50	2.423	104.6	958.2	296.1	5.283	1.0468
.75	2.433	104.6	958.2	296.2	5.295	1.0491
1.00	2.440	104.6	958.1	296.2	5.303	1.0507
1.25	2.443	104.6	957.8	296.3	5.310	1.0521
1.50	2.448	104.6	957.75	296.3	5.315	1.0531
1.75	2.454	104.6	957.7	296.2	5.320	1.0541
2.00	2.453	104.6	957.75	296.7	5.328	1.0557
2.25	2.453	104.6	957.75	296.8	5.329	1.0559
2.50	2.442	104.6	957.8	297.1	5.323	1.0547
2.75	2.453	104.6	957.8	297.1	5.335	1.0571
3.00	2.461	104.6	957.8	297.0	5.341	1.0583
3.25	2.463	104.6	957.6	297.0	5.344	1.0588
3.50	2.468	104.6	957.4	297.0	5.351	1.0602
3.75	2.466	104.6	957.3	297.2	5.353	1.0606
4.00	2.468	104.6	957.3	297.2	5.355	1.0610
5.00	2.463	104.6	956.2	297.6	5.363	1.0626
5.00	2.453	83.6	956.2	297.6	5.333	1.0567
5.50	2.452	83.6	955.7	297.7	5.337	1.0575
5.50	2.436	62.8	955.7	297.7	5.302	1.0505
6.00	2.436	62.8	955.7	297.8	5.303	1.0507
6.00	2.420	41.9	955.7	297.8	5.268	1.0438
6.50	2.411	41.9	955.4	297.9	5.262	1.0426
6.50	2.395	20.9	955.4	297.9	5.227	1.0357
7.00	2.406	20.9	955.5	297.9	5.238	1.0378

Test #11

Date: 9 February 1977

Tetroon Type: T-PR102-6.000

Tetroon Weight: 2.940 kg

Tare Weight: .0055 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V_0</u>
Initial	2.861	5	961.0	296.9	5.976	1.000
0	2.885	19.75	961.0	297.0	6.018	1.0070
.25	2.885	19.75	961.0	297.1	6.020	1.0074
.50	2.902	19.75	961.0	296.9	6.034	1.0097
1.00	2.886	19.75	961.0	297.3	6.025	1.0082
1.25	2.884	19.75	961.0	297.3	6.023	1.0079
1.50	2.887	19.75	961.0	297.5	6.030	1.0090
1.75	2.880	19.75	961.0	297.5	6.023	1.0079
2.00	2.887	19.75	961.0	297.8	6.036	1.0100
2.25	2.872	19.75	961.0	297.9	6.023	1.0079
2.50	2.877	19.75	961.0	297.9	6.028	1.0087
2.75	2.872	19.75	960.9	298.1	6.027	1.0085
3.25	2.889	19.75	960.9	298.1	6.045	1.0115
3.50	2.873	19.75	960.8	298.1	6.029	1.0089
3.75	2.873	19.75	960.65	298.5	6.038	1.0104
4.00	2.874	19.75	960.5	298.4	6.038	1.0104
4.00	3.002	98.74	960.5	298.5	6.256	1.0469
5.00	3.060	98.74	960.0	299.1	6.333	1.0597
5.00	3.054	79.0	960.0	299.1	6.305	1.0551
5.50	3.070	79.0	959.9	297.4	6.287	1.0520
5.50	3.055	59.24	959.9	297.4	6.250	1.0459
6.00	3.065	59.24	959.9	297.3	6.259	1.0474
6.00	3.049	39.5	959.9	297.3	6.221	1.0410
6.50	3.053	39.5	959.9	297.2	6.225	1.0417
6.50	3.035	19.75	959.9	297.2	6.186	1.0351
7.00	3.035	19.75	959.9	297.1	6.186	1.0351

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Test #12

Date: 11 February 1977

Tetroon Type: T-PR102-6.000

Tetroon Weight: 2.954 kg

Tare Weight: .0155 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V₀</u>
Initial	3.116	5	963.0	296.3	6.238	1.0000
0	3.127	39.5	963.0	296.4	6.287	1.0079
.25	3.138	39.5	963.1	296.7	6.305	1.0107
.50	3.136	39.5	963.0	296.6	6.301	1.0101
.75	3.136	39.5	963.1	296.9	6.307	1.0111
1.00	3.134	39.5	963.2	296.8	6.302	1.0103
1.25	3.148	39.5	963.1	296.2	6.304	1.0106
1.50	3.153	39.5	963.1	296.1	6.307	1.0111
1.75	3.160	39.5	963.1	295.8	6.308	1.0112
2.00	3.148	39.5	963.0	296.1	6.303	1.0104
2.25	3.133	39.5	963.0	296.9	6.304	1.0106
2.50	3.128	39.5	963.1	297.1	6.303	1.0104
2.75	3.128	39.5	963.1	297.0	6.301	1.0101
3.00	3.138	39.5	963.2	296.6	6.302	1.0103
3.25	3.150	39.5	963.3	296.1	6.303	1.0104
3.50	3.156	39.5	963.2	296.0	6.308	1.0112
3.75	3.156	39.5	963.2	296.0	6.308	1.0112
4.00	3.155	39.5	963.2	296.0	6.307	1.0111
4.00	3.258	98.74	963.0	296.0	6.478	1.0385
5.00	3.326	98.74	962.5	296.1	6.555	1.0508
5.00	3.306	79.0	962.5	296.1	6.512	1.0439
5.50	3.303	79.0	962.4	295.9	6.505	1.0428
5.50	3.293	59.24	962.4	295.9	6.473	1.0377
6.00	3.287	52.24	962.4	295.9	6.467	1.0367
6.00	3.270	39.5	962.4	295.9	6.428	1.0305
6.50	3.270	39.5	962.4	295.9	6.428	1.0306
6.50	3.245	19.75	962.4	295.9	6.381	1.0229
7.00	3.237	19.75	962.4	295.9	6.373	1.0216

Test #13
 Tetron Type: T-PR102-6.000
 Tetron Weight: 2.950 kg
 Tare Weight: .0065 kg

Date: 14 February 1977

Time (hr)	Scale (kg)	ΔP (mb)	P_a (mb)	T (°K)	V (m ³)	V/V ₀
Initial	3.096	5	962.7	296.3	6.206	1.000
0	3.163	59.24	962.7	296.3	6.332	1.0203
.25	3.163	59.24	962.8	296.5	6.336	1.0209
.50	3.165	59.24	962.8	296.5	6.338	1.0213
.75	3.166	59.24	962.8	296.6	6.341	1.0218
1.00	3.165	59.24	962.8	296.8	6.344	1.0222
1.25	3.156	59.24	962.8	296.9	6.337	1.0211
1.50	3.148	59.24	962.8	297.2	6.335	1.0208
1.75	3.166	59.24	962.8	296.7	6.343	1.0221
2.00	3.177	59.24	962.8	296.3	6.346	1.0226
2.25	3.177	59.24	962.8	296.2	6.344	1.0222
2.50	3.182	59.24	962.8	296.1	6.347	1.0227
2.75	3.176	59.24	962.5	296.1	6.342	1.0219
3.00	3.161	59.24	961.5	296.9	6.344	1.0222
3.25	3.158	59.24	960.8	297.1	6.357	1.0243
3.50	3.163	59.24	960.7	297.1	6.362	1.0251
3.75	3.166	59.24	960.6	296.0	6.366	1.0258
4.00	3.171	59.24	960.6	296.2	6.352	1.0235
4.00	3.243	98.74	960.55	296.2	6.470	1.0425
5.00	3.326	98.74	960.10	296.3	6.562	1.0574
5.00	3.303	79.0	960.10	296.3	6.516	1.0500
5.50	3.305	79.0	960.10	296.3	6.518	1.0503
5.50	3.283	59.24	960.10	296.3	6.474	1.0432
6.00	3.288	59.24	960.20	296.2	6.476	1.0435
6.00	3.268	39.5	960.20	296.2	6.444	1.0367
6.50	3.260	39.5	960.20	296.1	6.424	1.0351
6.50	3.246	19.75	960.20	296.1	6.388	1.0293
7.00	3.238	19.75	960.20	296.1	6.380	1.0280

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Test #14
 Tetron Type: T-PR102-6.000
 Tetron Weight: 2.944 kg
 Tare Weight: .0135 kg

Date: 15 February 1977

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>(°K)</u>	<u>V</u> <u>(m³)</u>	<u>V/V₀</u>
Initial	3.213	5	974.4	295.3	6.230	1.0000
0	3.310	79.0	974.45	295.3	6.406	1.0283
.25	3.310	79.0	974.6	295.5	6.409	1.0287
.50	3.316	79.0	974.6	295.5	6.415	1.0297
.75	3.316	79.0	974.6	295.7	6.419	1.0303
1.00	3.318	79.0	974.5	295.5	6.418	1.0302
1.25	3.313	79.0	974.5	296.0	6.424	1.0311
1.50	3.313	79.0	974.5	296.0	6.424	1.0311
1.75	3.321	79.0	974.45	296.0	6.432	1.0324
2.00	3.315	79.0	974.6	296.2	6.429	1.0319
2.25	3.313	79.0	974.55	296.3	6.430	1.0321
2.50	3.313	79.0	974.6	296.4	6.431	1.0323
2.75	3.308	79.0	974.5	296.5	6.429	1.0319
3.00	3.303	79.0	974.55	296.8	6.430	1.0321
3.25	3.306	79.0	974.5	296.9	6.436	1.0331
3.50	3.308	79.0	974.3	296.8	6.437	1.0332
3.75	3.305	79.0	974.1	296.9	6.437	1.0332
4.00	3.310	79.0	974.0	297.0	6.445	1.0345
4.00	3.331	98.74	974.0	296.8	6.484	1.0408
5.00	3.382	98.74	973.2	296.9	6.554	1.0520
5.00	3.357	79.0	973.2	296.9	6.497	1.0429
5.50	3.357	79.0	972.8	297.0	6.502	1.0437
5.50	3.331	59.24	972.8	297.0	6.454	1.0360
6.00	3.315	59.24	972.5	297.7	6.455	1.0361
6.00	3.290	39.50	972.5	297.7	6.408	1.0286
6.50	3.280	39.50	972.35	297.8	6.401	1.0274
6.50	3.255	19.75	972.35	297.8	6.354	1.0199
7.00	3.274	19.75	972.30	297.0	6.357	1.0204

Test #15

Date: 16 February 1977

Tetroon Type: T-PR102-6.000

Tetroon Weight: 2.929 kg

Tare Weight: .0035 kg

<u>Time</u> <u>(hr)</u>	<u>Scale</u> <u>(kg)</u>	<u>ΔP</u> <u>(mb)</u>	<u>P_a</u> <u>(mb)</u>	<u>T</u> <u>($^{\circ}K$)</u>	<u>V</u> <u>(m^3)</u>	<u>V/V₀</u>
Initial	3.033	5	950.5	296.4	6.198	1.0000
0	3.175	98.74	950.5	296.6	6.451	1.0408
.25	3.213	98.74	950.45	296.6	6.492	1.0474
.50	3.237	98.74	950.45	296.5	6.515	1.0511
.75	3.255	98.74	950.45	296.7	6.538	1.0549
1.00	3.270	98.74	950.45	296.7	6.554	1.0574
1.25	3.273	98.74	950.5	296.7	6.557	1.0579
1.50	3.283	98.74	950.5	296.8	6.570	1.0600
1.75	3.297	98.74	950.5	296.8	6.585	1.0624
2.00	3.310	98.74	950.5	296.8	6.598	1.0645
2.25	3.313	98.74	950.6	296.8	6.601	1.0650
2.50	3.312	98.74	950.8	297.0	6.603	1.0653
2.75	3.309	98.74	951.0	297.2	6.603	1.0653
3.00	3.305	98.74	951.0	297.5	6.605	1.0657
3.25	3.335	98.74	951.5	296.4	6.609	1.0663
3.50	3.353	98.74	951.7	296.1	6.620	1.0681
3.75	3.370	98.74	951.9	295.8	6.629	1.0695
4.00	3.340	98.74	951.9	297.0	6.625	1.0689
5.00	3.378	98.74	952.9	296.1	6.638	1.0710
5.00	3.362	79.0	952.9	296.1	6.598	1.0645
5.50	3.362	79.0	953.2	296.3	6.601	1.0650
5.50	3.338	59.24	953.2	296.3	6.554	1.0574
6.00	3.324	59.24	954.0	297.1	6.551	1.0570
6.00	3.313	39.5	954.0	297.1	6.518	1.0516
6.50	3.327	39.5	955.0	296.3	6.508	1.0500
6.50	3.310	19.75	955.0	296.3	6.469	1.0437
7.00	3.297	19.75	955.1	296.2	6.452	1.0410